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ABSTRACT

This report examines the first generation of the National Science Foundation (NSF)-funded Implementation and Dissemination Centers. It portrays the experiences of and captures the lessons learned in such a way that it informs the design of future centers. Ideas drawn from the discussions that took place at a conference held in Annapolis, Maryland in June 2001 are presented. Analytical in its perspective, this report discusses the key dimensions along which center design decisions must be made and defines the goals and the work of the centers. An analysis of the trade-offs that exist for different decisions within each of the key design dimensions is presented. An attached appendix contains three design scenarios that bring together sets of design decisions and offer alternative ways to construct future centers. Overarching thoughts on the importance of the centers and the role that they can play in promoting mathematics and science education are discussed. (KHR)

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The NSF Implementation and Dissemination Centers:

An Analytic Framework

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December 2001

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The NSF Implementation and Dissemination Centers:

An Analytic Framework

OVERVIEW

This report examines the first generation of the National Science Foundation-funded Implementation and Dissemination Centers. Its purpose is to portray the experiences of and capture the lessons learned by these Centers in such a way that it informs the design of future Centers. The ideas presented in this report are largely drawn from the discussions that took place at a conference held in Annapolis, Maryland in June 2001.[1] The conference included leaders of all eight Implementation and Dissemination Centers, outside experts,[2] as well as several NSF program officers.

Analytical in its perspective, this report discusses the key dimensions along which Center design decisions must be made. These design decisions define the goals and the work of Centers, and this paper presents an analysis of the trade-offs that exist for different decisions within each of the key design dimensions. Also presented (in an attached appendix) are three "design scenarios" that bring together sets of design decisions and offer alternative ways to construct future Implementation and Dissemination Centers. Finally, the paper concludes with overarching thoughts about the importance of the Centers and the roles that they can play in promoting mathematics and science education reform.

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[1] The conference, "Design, Research, Re-Design: The Next Generation of Curriculum Implementation Centers," was funded in May 2001 by NSF, Award #0121508.

[2] The outside experts included curriculum developers, district mathematics and science specialists, and evaluators.

I. INTRODUCTION

Background

As part of its fundamental mission, the National Science Foundation (NSF) is charged with improving the nation's mathematics and science education. In pursuing this mission, NSF has invested in a range of resources and pursued various strategies in its attempt to contribute to the quality of mathematics and science education in the K-12 system.

For example, during the past decade NSF has supported multiple efforts of leaders in the field in developing national standards[3] for both mathematics and science education. These standards all outline an ambitious vision of teaching and learning – a vision that has not yet been achieved in practice in a vast majority of the nation's classrooms. Also within the past decade, NSF and others have come to understand that widespread and significant changes in science and mathematics instruction will not come easily; rather, "systemic change" will be required to achieve that vision. That is, high-quality instruction will require a strong and robust system that has all of its components aligned toward the achievement of a standards-based vision of instruction. And it is clear that a "standards-based" curriculum is one of the most essential components of the system which must be in place to achieve that vision.

For the past three decades NSF and other foundations have invested hundreds of millions of dollars in the development of new mathematics and science curricula. These curricula have ranged from supplementary units to multi-year programs and have included the development of sophisticated instructional materials as well as the innovative use of technology.

By nature, these curricula are "innovative": They draw on new structures and approaches and are designed to include new topics, new uses of technology, new pedagogies, innovative ways of integrating subject matter disciplines, and/or new assessment techniques. These curricula are meant to be vehicles for promoting reform in science and mathematics education and for altering the fundamental way these disciplines are taught. They are meant to serve as supports for those leaders and "change agents" who seek to improve their own focal mathematics and science programs. The NSF-funded curricula are meant to reflect the best thinking of scientists, mathematicians, and educators. Consequently, their designs are <u>not</u> primarily driven by market forces. Rather the NSF-funded curricula, because they are innovative by definition, are curricula that would <u>not</u> otherwise be published by major curriculum publishers.

While the NSF-funded curricula are likely to be of the highest quality in terms of the mathematics and science they present, and while they are likely to promote a student-centered and inquiry-based vision of teaching and learning, these curricula will not necessarily produce

[3] *National Science Education Standards*, National Academy Press (Washington DC: 1996). *Benchmarks for Science Literacy: Project 2061*, American Association for the Advancement of Science, Oxford University Press (New York: 1993). *Principles and Standards for School Mathematics*, National Council of Teachers of Mathematics (Reston, VA: 2000). *Professional Standards for Teaching Mathematics*, National Council of Teachers of Mathematics (Reston, VA: 1991).

immediate or heavy demand. The fact that these new curricula are designed to be congruent with, and supportive of, the national standards does not guarantee them a large market share. On the contrary, the standards-based curricula, because they are innovative and because they demand new modes of instruction, require more expertise, resources, time and effort to implement. The NSF-funded curricula are not only more demanding, but they are also forced to compete with more traditional curricula that are supported by millions of publisher advertising and marketing dollars.

NSF recognizes that there is a tension between its goals of 1) supporting high-quality innovative curricula, and 2) achieving widespread usage. They recognize the need to provide additional support to those who embark on the path of using these new curricula. In its Request For Proposals (RFP), NSF says of its own Instructional Materials Development (IMD) program:

> *IMD supports (curriculum development) projects that are national in scope and significance. These projects should have the potential to enhance student learning and make a significant and noticeable impact on the national market for instructional materials....*
>
> *The goal of the IMD program as a whole is the development of high-quality instructional and assessment materials to enhance Science, Mathematics, and Technology (SMT) content knowledge, as well as the thinking skills and problem solving abilities of all students, regardless of background, ability, or future education plans. The materials should promote positive student attitudes toward SMT and positive perceptions of themselves as learners. The materials also should encourage a broad cross section of students to pursue SMT education through the use of real-world contexts and/or providing an understanding of the role of SMT in the workplace. Achievement of these goals often requires improvement of teachers' content knowledge and pedagogical strategies. IMD projects, therefore, often need to provide support to teachers to help them extend their content knowledge and pedagogical skills....*

Through their IMD program, NSF has funded many different kinds of curriculum development projects – all of which are intended to promote a vision of teaching and learning consistent with the national standards. But given the demands of the standards and the demands of the new curricula, experience has shown that districts and schools, in fact, do need extensive support in learning about, adopting, and implementing these new more sophisticated curricula. Accordingly, in 1996, the first RFP for "implementation sites" was issued by NSF:

> *Science and mathematics education reform requires classroom implementation of high-quality standards-based instructional materials, together with a comprehensive program of professional development for teachers... along with the alignment of district policy, practice and resources. The Instructional Materials Development and Teacher Enhancement Programs seek to establish implementation sites that will provide information and technical assistance to decisionmakers who are responsible for selecting materials and ensuring their implementation in those districts that have decided to implement NSF-supported exemplary materials. These sites should increase awareness of alternatives; identify strategies for selection of materials that are appropriate for local needs; and provide the technical assistance necessary for broad scale implementation....*

Over the next five years, from 1996 to 2001, NSF funded eight Implementation and Dissemination sites.

The table on the following page provides an overview of the Implementation and Dissemination Centers that were part of this "first generation" of sites – all of which had representatives at the June 2001 conference in Annapolis.

These Centers cover both mathematics and science education from kindergarten through 12th grade. They also, theoretically, cover the nation's 16,000 school districts and 80,000 schools.

It is worth noting here that this first generation of implementation sites provides NSF with five years of experience in promoting the selection, adoption, and implementation of standards-based curricula. This is a short period of time compared to the nearly forty years the Foundation has been supporting curriculum development projects. It is also worth noting that this first generation of Implementation Centers serendipitously provides NSF with an experiment that includes instructive natural variation: These first eight Centers vary significantly in their approach, strategies, priorities, goals and audiences. Hence, it makes sense to learn from this early experience, to gather the lessons learned to date, and use this information and insight to think about the design of the next generation of Implementation and Dissemination Centers.

First Generation NSF-funded Implementation and Dissemination Centers

NAME	HOST INSTITUTION	DISCIPLINE	GRADE LEVEL	GEOG. FOCUS	NUMBER OF CURRICULA DISSEMINATED
K-12 Mathematics Curriculum Center (K-12 MCC)	Education Development Center, Inc. (EDC), Newton, MA	Mathematics	K-12	National	13
Alternatives for Rebuilding Curriculum (ARC) Center	COMAP, Inc. The Consortium for Mathematics and Its Applications, Lexington, MA	Mathematics	K-5	National	3
Show-Me Center	University of Missouri, Columbia, MO	Mathematics	6-8 (middle school)	National	5
Curricular Options in Mathematics for All Secondary Students (COMPASS)	Ithaca College, Ithaca, NY	Mathematics	9-12	National	5
IMPACT New England at CESAME	Center for the Enhancement of Science and Mathematics Education (CESAME), Boston, MA	Mathematics and Science	K-12	Regional: New England	47
The Leadership and Assistance for Science Education Reform (LASER) Center at NSRC	National Science Resources Center (NSRC), Washington, DC	Science	K-8	National	6
EDC K-12 Science Curriculum Dissemination Center	Education Development Center, Inc. (EDC), Newton, MA	Science	K-12	National/ Rural Regions	31
The Science Curriculum Implementation (SCI) Center at BSCS	BSCS, Colorado Springs, CO	Science	9-12	National	17+

This Report

This report is aimed at extracting and distilling lessons learned from this first generation with an eye toward the design of future Centers. It is meant to help the reader think about the design of the next generation of Centers in two ways: 1) the level of the individual Center; and 2) the level of the overall Center Initiative design. At the level of the individual project there is much to be learned and shared about the design choices made by projects as they structure and carry out their work. At the level of the initiative, NSF can learn from all projects about the best way to structure its future RFPs and to choose the duration and level of funding for Centers.

In presenting an analysis of design choices at both the project and initiative level, this report primarily draws upon discussions that were held at a conference sponsored by Inverness Research Associates in Annapolis, Maryland in June 2001. Additionally, we drew upon our work as evaluators of the COMPASS Center, the SCI Center at BSCS and the EDC K-12 Mathematics Curriculum Center. We had the opportunity to participate in, and present our research at, the 2000 and 2001 Gateways conferences.[4] We also had the opportunity to work with NSF program officers on these ideas.[5]

This report is meant to provide an analytic framework for project leaders as well as NSF program designers. It is important to note that it is not meant to prescribe a certain design or approach to designing Implementation and Dissemination Centers. In that sense, this report does not provide recommendations. Rather, as part of our analysis, we draw upon conference discussions and other sources of information described above to do four things:

1) To explore the mission of the Centers and their goals.

2) To provide a description of the dimensions along which the current Centers vary most significantly, and of the dimensions that are important to consider in future design decisions at both the project and initiative level. We outline choices that can be made in each dimension, as well as relative benefits and costs of each choice.

3) To provide three different "Design Scenarios" where each scenario includes a set of choices along the key design dimensions. These three scenarios are presented in an appendix as a way of illustrating what we see as fundamentally different approaches to thinking about the work of the Centers.

4) To summarize overarching ideas that emerged frequently during the conference, that help the reader understand the role and importance of the Centers in the larger picture of NSF's reform initiatives.

[4] The Gateways Conference is the annual gathering of NSF-funded K-12 mathematics and science curriculum development and implementation projects.

[5] In March of 2001 we presented our survey research findings to a panel of NSF program officers at a day-long seminar designed to help promote further exploration of these ideas.

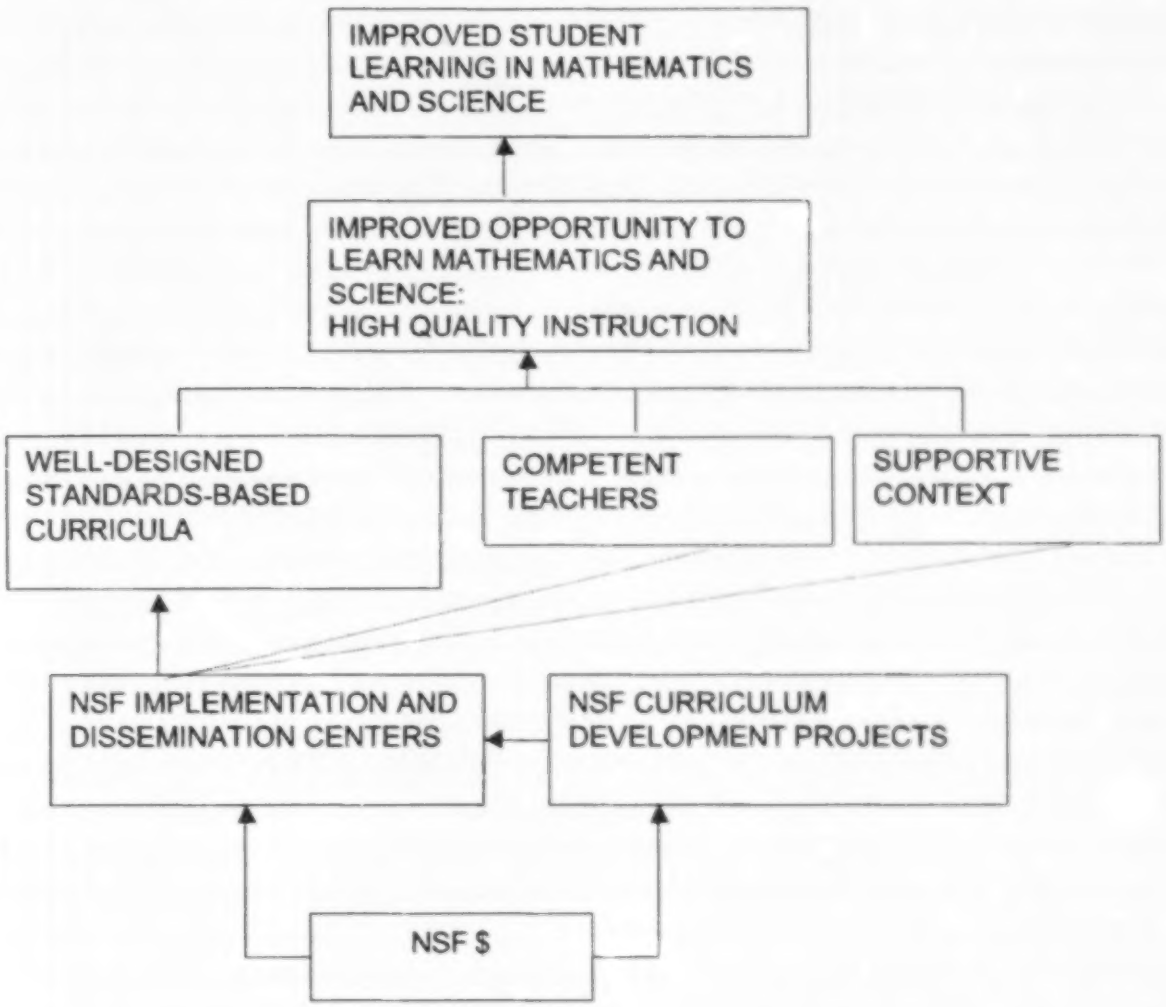
II. THE WORK AND GOALS OF THE CENTERS

Before we discuss critical design dimensions, we believe it is first necessary to illuminate the range of goals and strategies that the first generation of Centers are pursuing. It is clear from conversations at the conference, and from examining the range of strategies pursued by the Centers, that the initial vision of the Centers as "dissemination" Centers is oversimplified. That is, collectively these Centers are pursuing much more ambitious goals than simply spreading the word about these new curricula.

Mission of the Centers

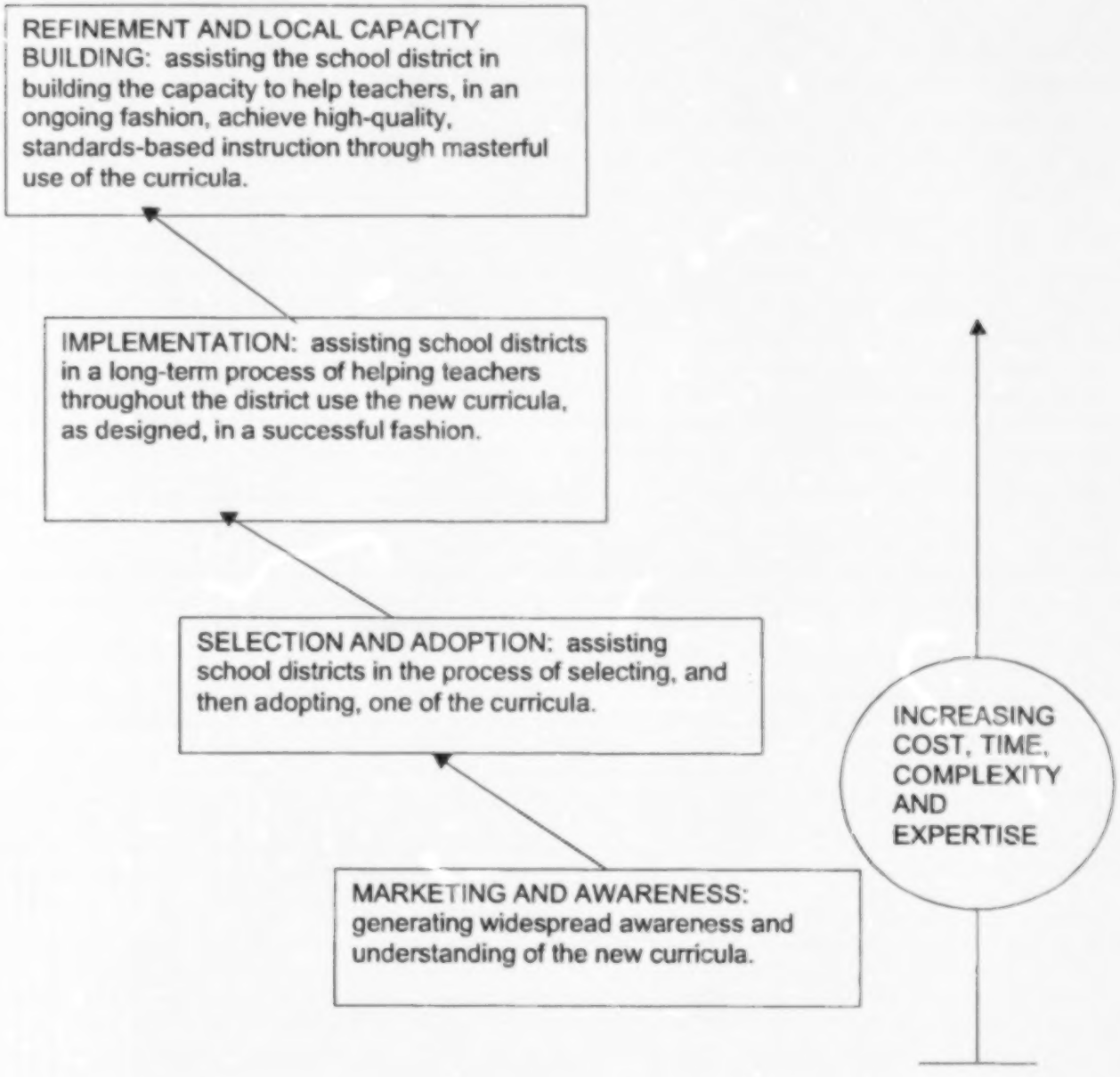
While the Centers vary in their priorities and strategies, it is clear that they all share a common mission: that is, to serve the nation's children by improving the quality of opportunities to learn mathematics and science. The Centers all seek to do this by facilitating the use of high-quality curricula and their associated instructional materials. Through the use of improved curricula, the Centers seek to improve thousands of classrooms, making them richer, more challenging, and more interesting places to learn mathematics and science. Moreover, for all of the Centers, there is an emphasis on equity, using these new curricular programs to increase access to high-quality instruction for those schools, teachers, and students who currently are not well served by the system. The diagram on the following page illustrates, in a simplified form, the overall logic of the Centers' work.

Logic of the NSF Investment


IMPROVED STUDENT LEARNING IN MATHEMATICS AND SCIENCE
IMPROVED OPPORTUNITY TO LEARN MATHEMATICS AND SCIENCE: HIGH QUALITY INSTRUCTION
WELL-DESIGNED STANDARDS-BASED CURRICULA
COMPETENT TEACHERS
SUPPORTIVE CONTEXT
NSF IMPLEMENTATION AND DISSEMINATION CENTERS
NSF CURRICULUM DEVELOPMENT PROJECTS
NSF $

Goals of the Implementation and Dissemination Centers

In working to achieve the mission of improved instruction through curricular reform, the Centers are actually pursuing multiple goals. These goals are, in a sense, developmental or layered a shown in the figure below.


REFINEMENT AND LOCAL CAPACITY BUILDING: assisting the school district in building the capacity to help teachers, in an ongoing fashion, achieve high-quality, standards-based instruction through masterful use of the curricula.
IMPLEMENTATION: assisting school districts in a long-term process of helping teachers throughout the district use the new curricula, as designed, in a successful fashion.
SELECTION AND ADOPTION: assisting school districts in the process of selecting, and then adopting, one of the curricula.
MARKETING AND AWARENESS: generating widespread awareness and understanding of the new curricula.
INCREASING COST, TIME, COMPLEXITY AND EXPERTISE

The diagram on the previous page shows the different levels and types of work that a Center can do as it assists a district or school through the stages of implementation. The work required at each level is not the same; in fact, at the conference it was proposed that the scale was logarithmic, like a Richter scale. That is, the work needed to help a district through the selection and adoption phases was ten times that required to simply make them aware of the curricula. And similarly, the work to get the curriculum implemented was again ten times the work required to help districts select and adopt the curricula. In what follows, we discuss the work that Centers are doing at each of these stages. Finally, we describe additional work that involves connections between the Centers as well as their connections with other reform efforts.

1) Marketing and Awareness

Obviously, it is a necessary but not sufficient condition that the curriculum decisionmakers in schools and districts become aware of, and knowledgeable about the standards-based curricula supported by the Centers. Our own surveys, and our visits to "curricular showcases" and conference presentations, illustrate the fact that there are many schools and districts across the country who are simply unaware of the existence of these curricula. Not surprisingly, there are also many districts that are unaware of the Implementation and Dissemination Centers and what they can offer.

At the conference, participants repeatedly made another point about the nature of "awareness." They argued that it was not enough for districts and schools to simply be aware of the existence of these curricula. Awareness also had to include helping them understand the essential differences between these curricula and standard textbooks. They had to be educated about the motivation for these curricula, their essential design features, and the ways in which these curricula are meant to serve as a leading edge of reform. Hence, the Centers often find themselves not only promoting their assigned curricula, but also educating schools and districts more broadly about standards and standards-based reform.[6]

2) Selection and Adoption

While the Centers hope that the districts they interact with will adopt one of the NSF curricula, they have goals that go beyond the achievement of that simple end. The Implementation and Dissemination Center leaders insist that much of their "awareness" work consists of increasing the sophistication of districts as they engage in selection and curriculum adoption processes. Indeed, it is the goal of many of the Centers to improve the capacity of school districts more generally by helping them learn how to carry out a more systematic process of curriculum review and selection. In fact, they want to help districts "reconceptualize the whole idea of curriculum" as well as that of "curriculum implementation."

[6] This work takes the form of workshops, conference presentations and a number of publications that both describe the specific curricula being disseminated, but also the processes needed for full and effective implementation of new curricula.

Centers want to move districts and schools beyond the "flip test" as they look through the pages of different textbooks and curricular programs. They want to help districts learn how to use, in a systematic fashion, "standards-based criteria" in their selection process. And they want the selection and adoption process to be based on a vision of teaching and learning – and not just on the topics listed in each of the textbook chapters. In short, Centers want to help districts think about adopting an instructional program, instead of a textbook; and they want the criteria used for selection to be embedded in a standards-based vision of teaching and learning, and not simply the coverage of topics.

3) Implementation

These Centers are called "Implementation" Centers because it is written into their mandate that they will provide some of the critical supports that are requisite to achieving district-wide or school-wide implementation. "Implementation," however, is not a simple process, and certainly is not a singular event. If the two prior Center goals – marketing, and selection and adoption – are actually not mere occurrences but long-term processes that require ongoing work, then that is true to an even greater degree for the process of implementation. While all Centers felt some responsibility for supporting implementation of adopted curricula, they varied widely in their strategies, the degree to which they pursued this goal, and the amount of resources they devoted to it.

As a comparison, the NSF-funded Local Systemic Change Projects (LSCs) are, to a very real extent, meant to be implementation grants. That is, they provide on the order of $3,000 per teacher to help districts implement a given curriculum. But the resources of the Centers allow only one tenth or even one hundredth of that level of support, so it is clear that the Centers cannot hope to do the work of an LSC in terms of supporting curriculum implementation. Hence, the whole notion of supporting implementation – a goal that all Centers espouse – involves a task that is virtually unlimited and endless, the complexities about which the Center community is just beginning to learn.

4) Refinement and Local Capacity Building

Centers not only have the goals of helping districts review, select, and implement new curricula, but they also design their efforts to develop the local district capacity to do further curricular reforms on their own. Many Centers say they design their work to create what they call "local curricular leadership." This kind of leadership can be said to exist when there are, within local schools and districts, individuals working at all levels of the system who have the knowledge, inclination, and political stature to sustain an ongoing process of curriculum improvement.

Centers are well-positioned to help develop, and also to benefit from local curricular leadership. Such leadership is both a necessary ingredient for the implementation of a new curriculum, but it is also a very important outcome of the process as well. That is, by helping local schools and districts engage in a thoughtful and careful process of reviewing, selecting and implementing a new curriculum, the Centers are very much in the business of developing local curricular

leadership. (It is interesting to note that the NSF teacher enhancement programs and the systemic programs are also developing local leadership, but the leadership that is a by-product of doing the curricular work is a specialized and grounded kind, needed as part of a district's overall capacity for reform.)

This development of local curricular capacity is not accidental for most Centers, nor does it only take the form of curricular leadership. Many Centers deliberately act as brokers trying to link districts and schools with other agencies, institutions and resources that can support their local reform efforts. For example, Centers can refer districts to curricular resources, such as publishers, showcases, and websites. They also try to link districts with appropriate professional development projects that can be of assistance in supporting the implementation of particular curricula. And often, Centers refer districts and schools to other NSF projects, including other Centers.

Centers also work hard to develop another form of local curricular capacity. They help district leaders understand the need for broader community understanding of, and support for, new curricula. The more innovative a curriculum is, the more likely it is to be controversial. Districts and schools need to be able to represent the curriculum to the public and the rationale they have for adopting it. This involves skill in dealing with school boards, administrators, parents, students and corporations. In short, many of the Centers seek to increase the political awareness and skills of the local curricular leaders. The successful adoption and implementation of a new curriculum, the Centers argue, not only depends on the work it takes to get the curriculum taught well, but also on the ability of local leaders to create a supportive public and community context for that curricular innovation.

5) The Development of National Infrastructure for Supporting New Curricula

The previous goals we have described revolve around the work of individual Centers as they work with schools and districts. However, it became clear in our conference that there were other goals – what one might think of as collective goals or even initiative-level goals – that helped to define the work of the Centers. Centers work not only on the local level – with schools, districts and universities – but they also work to create broader connections and resources that can serve as a kind of national infrastructure for curricular reform. In a very similar way that connections and relationships are developed locally, the Centers work at a national level providing connections between many other projects and reform efforts. A strong byproduct of their work, again, is curricular leadership – only this time at a national level.

The Centers, for example, are well-positioned to work with other NSF projects, particularly the LSCs and other Systemic Initiatives. Implementation Centers can foster a kind of mutually beneficial relationship between curriculum projects and the NSF systemic initiatives: the curriculum projects need supportive contexts for their implementation, and the resources of the NSF projects greatly enhance the likelihood that the curricula will be implemented. Similarly, the NSF projects need assistance and specific expertise as they help local districts and schools review, select, and implement standards-based curricula as one component of their overall systemic change process.

It is also important to note that at least some of the Centers have strong symbiotic relationships with the curriculum development projects that spawned the curricula included in the work of the Center. This relationship affords a chance for the curriculum developers to connect with potential "consumers" of their curricula. The developers get the opportunity to learn a great deal about the districts, schools, and teachers they are seeking to serve, and, in turn, district leaders can learn directly from the developers about the design and intent of specific curricula. This interaction also contributes to curriculum developers as they revise existing curricula and develop new ones.

It is also worth mentioning that Centers are sponsoring and supporting what might be called "applied research on curriculum implementation." The national surveys that Inverness Research Associates conducted, with the support of several Centers, are a good example of the kinds of studies that can inform future curriculum development and implementation efforts. Similarly, other Centers are conducting case studies of the processes that districts undertake in their work to adopt and implement standards-based curricula.

All of these efforts suggest that the Centers have a potentially very important role to play in creating what might be best thought of as a national curriculum network – a web of projects and reform leaders – all of whom are part of the larger process of developing and implementing standards-based curricula. At the nucleus of the network are the Implementation and Dissemination Centers, and connected to them are the LSC and systemic initiatives; state mathematics and science leaders; university-level mathematics and science educators; researchers; and local schools and districts. This network can work together and reinforce each others' efforts to improve K-12 mathematics and science education.

III. KEY DIMENSIONS OF CENTER DESIGN

In order to accomplish the mission and pursue the goals of the Implementation and Dissemination Centers listed in preceding sections, the Centers make decisions along a few critically important "design dimensions." That is, the designers of each site, as well as the designers of the Initiative itself, must resolve how to both focus and constrain choices in each of the following dimensions. The current generation of Centers varies significantly in how they address each dimension. Accordingly, there are lessons to be learned about the design decisions Centers have made regarding:

- Mathematics and/or Science Focus
- Geography and Target Audience
- Grade Level Foci
- Additional Foci or Specialties

In this section of the report, we discuss the choices to be made in each dimension and the trade-offs that come with each choice.

1) Mathematics and/or Science Focus

One of the first choices the designers of Centers (and of the Initiative) have to make is to decide whether Centers should cover both mathematics and science, or specialize in one or the other. The nature of the disciplines, the characteristics of the new curricula, and the challenges of implementation, are quite different for the two disciplines. Not surprisingly, it is very clear from the conference discussions, as well as from the analysis of extant standards-based curricula, that mathematics and science education are in very different places vis-à-vis the status of and issues surrounding curriculum implementation.

In mathematics there tends to be fewer curricula, with each curriculum focusing on multi-year, coherent, and often integrated programs. In science, especially at the high school and middle school levels, there are multiple disciplines, resulting in far more curricula with each curriculum generally covering a year or less in scope. Consequently, the challenges of implementation are very different for the two disciplines.

Let us be more specific about the contrasts between the two disciplines:

- In mathematics, many curricula are programmatic in design – that is, the curricula are comprehensive, multi-year, integrated, and highly innovative compared to traditional mathematics courses. In science, particularly at the high school level, the NSF-funded curricula tend to be of a much smaller "grain size" ranging from modules that last a few weeks, to year-long courses, to (a few) multi-year integrated programs. (There is little evidence that there is a market demand or acceptance for multi-year science programs at the high school level.)

- The mathematical domain is singular and relatively well-defined. The different mathematics curricula often cover the same topics and share a more or less common philosophy. They differ in the ways in which, and the degree to which, they are innovative in their structure and approach. Science involves multiple disciplines (earth, physical, chemical, and biological). Different years of science in school tend to involve different science disciplines. Different years in mathematics may involve different mathematical fields (e.g., algebra, geometry, calculus, etc.), but the distinctions are smaller than those in science. The result is that there tend to be many more science curriculum development projects, and many more science curricula to be disseminated. (At the high school level, there are five mathematics programs in contrast to seventeen different science curricula.)

- The Science Implementation Centers tend to be newer than the Mathematics Centers.

- Those involved in mathematics education reform, and those leading the effort to implement innovative curricula, often face political opposition, especially in the current climate of high-stakes accountability. Science, by contrast, often comes into a district "under the radar screen" and, with the exception of evolution, does not generate the same degree of political scrutiny or controversy as many of the mathematics curricula.

- In mathematics, the curriculum developers tend to remain with the curriculum development project and take part in the dissemination and implementation effort. In science, because the efforts are smaller and involve shorter-term and less well-funded efforts, developers tend to move onto other projects and are less available for assisting the dissemination efforts.

- Mathematics, especially at the elementary and middle school levels, is a high priority for most districts. Science, by contrast is often seen by district administrators (not science teachers!) as a "secondary subject area;" hence a part of the implementation challenge facing science is simply achieving recognition.

Seven out of the eight current Centers are focused on mathematics or science, but not both. One (regional) Center is focused on both mathematics and science. This must be taken into account as one considers the arguments made for each option. The advantages and disadvantages of each choice are articulated below.

Separate Mathematics and Science Centers

Most of the conference participants felt it was better to have their Centers focus either on mathematics or on science, but not on both.

- Because the status of educational reform, the nature of the curricula and the challenges of implementation are, as described above, so different for the two disciplines, it makes sense for a Center to focus on one discipline exclusively.

- A Center that focuses on mathematics or science is able to garner the expertise and knowledge that is specific to that discipline, to the curricula of that discipline, and to the challenges of implementation faced by that discipline. Simply put, each Center felt that they were challenged enough in handling one discipline, let alone trying to handle two.

- Many scientists and mathematicians feel strongly that their disciplines should be taught separately.

- The downside to having Centers focus on either mathematics or science, but not both, is that they forfeit the advantages and synergies of the Centers that combine the two.

Combined Mathematics and Science Centers

The one combined regional Center at the conference made the case for serving both mathematics and science.

- Center staff, in working with both disciplines and both reform communities, can combine the strengths and unique features of each discipline. They also may be able t achieve and then share a more integrated view of the two subject areas. Combined Centers, they argue, can allow for greater cross-fertilization of ideas and learning from both the mathematics and science education communities.

- Centers that support both mathematics and science can serve a school or district in both disciplines, which facilitates the development of long-term supportive relationships with the local administrators and change agents. In this way they can work more broadly over longer periods of time assisting districts with their overall reform efforts. Hence, combined Centers may allow for a more "client-focused" approach that can serve all of a district's mathematics and science needs.

- Many educators argue for the benefits of integrating mathematics and science instruction.

- There are also clear disadvantages, or at least challenges, for Centers that try to focus on both mathematics and science. It is difficult to garner sufficient staff expertise to cover both mathematics and science content knowledge. It is difficult for staff to be experienced in and knowledgeable about the many different curricula that are involved in a combined Center. It is also difficult for staff to make connections with both national communities and with relevant NSF initiatives.

Summary

In essence, the choice of Centers vis-à-vis their mathematics and science focus is one of priorities. A Center with a specialization in mathematics or science is the choice to be made if one believes that disciplinary expertise and knowledge of specific curricula is paramount. A

Center that combines the two is reasonable if one believes that client relationships, an integrated curricular perspective, and multi-faceted service are most important. If Centers are to be discipline-specific, there is certainly no reason that there could not be considerable interaction, communication, and sharing of work between the mathematics and science Centers.

2) Geography and Target Audience

Most of the current Centers are national in their reach and primary intended audience. Some make a large effort to serve audiences across the country; others are open to national service, but end up focusing their efforts in some regions more than others.

Three Geographical Strategies

At the conference, three distinct geographical strategies emerged. Two of these involve "national" Centers. One was a regional design.

There are really two types of national Centers. The first type of national Center has an established central site that is connected with a set of regional satellites or hubs around the country. The function of the local satellite is to provide a regional base for workshops, showcases and other Center activities.

The second type of national Center is structured more around the curriculum developers who are themselves nationally distributed. In this case, the satellites consist of the curriculum developers and thus each satellite has a curricular focus and specialization. The Center seeks to achieve national scope in its work through the geographical distribution of the satellites, but, more importantly, through the use of other agencies, initiatives, projects and networks.

Another design choice for a Center (of which there is currently one), is to serve a specific region rather than to be national in scope. In this case, the regional Center might well serve all the local districts and schools in the area by helping them in both mathematics and science K-12.

National Centers with Geographic Hubs and Satellites

First, let us look at the Centers that are national in scope and have geographic (regional) satellites and hubs. The following advantages and challenges exist for these Centers:

- The central (node) site of these national Centers can recruit and generate strong centralized national leadership.

- These Centers can create and support local hub leaders – people who know their own region, districts, schools, state standards, and local cultures. In addition, these local hubs are well-positioned to do "follow-up" work that is required in local implementation efforts.

- Over time, Centers with a web of hubs can work together to create a national network and achieve national coverage.

- The hub leaders are potential new leaders of mathematics and science reform for their regions. Through support they receive from the central node, and from the outreach work they do, they become knowledgeable and well-positioned to promote reform in their region. This raises the possibility of using Centers and their satellite networks to develop a next generation of curricular leaders.

- Some of the hubs build on the cumulative past work of previous projects, and in this sense, the satellite structure of regional hubs allows Centers to provide continued support for deployment of assets built by past efforts.

- In terms of challenges, hub leaders tend to be part-time and thus have their Center work as only one of their many responsibilities. Hence, it may be difficult to get the time, attention and expertise required to carry out a strong local hub's curricular leadership role.

- It is also difficult for the developers, publishers and experts in the specific curricula to work with multiple hubs and multiple hub leaders. Consequently, many hubs and hub leaders may be far removed from the deep curriculum expertise that has been accumulated by the developers, publishers and experienced teachers associated with each curriculum.

- Curricular leadership capacity is hard to find, develop and maintain; thus, the hub model relies on the ability of the Center to find and manage numerous hub leaders. This is a difficult and demanding task, and there is the danger that the highly skilled centralized leadership will spend inordinate amounts of time and effort on managing far less skilled local leadership.

National Centers with Curriculum Development Projects as Satellites

In the second type of national Center, the satellite sites are not primarily vehicles for achieving national distribution; rather, they are comprised of curriculum development projects. In this case the central site is a "neutral node" that promotes all of the curricula represented in the satellite sites.

The key advantages and disadvantages of this structure are the following:

- In a direct fashion these Centers bring to the work the knowledge, skills and expertise of the individuals involved in the development of the curricula that are being disseminated. Because of this, the Center can offer districts, initiatives, and other projects real assistance with each of the curricula it covers.

- Centers that have curriculum projects as satellites can work at two different levels: The central site can promote all of the curricula covered by the Center, while each satellite can offer more in-depth work around the curricula they are most familiar with.

- Having a central node and curriculum projects as satellites allows for a networking and sharing of work between curriculum projects that otherwise is not likely to occur.

- A major challenge for this kind of Center is faced by the central site, which must develop a "neutral stance" toward all of its satellites, as well as facilitate and coordinate the work of satellites (curriculum developers) who have the potential of being competitive with each other.

- Another major challenge for this type of Center is achieving national outreach and scope. The satellites can use their regional knowledge to assist here, but it is up to the central site to establish collaborations with other initiatives and networks so that the work of the Center is truly national in scope.

Regional Centers

A very different approach can be found in the regional model. Here the Center seeks to establish a local presence and ongoing relationships with local schools, districts, universities, and other local projects involved in K-12 mathematics and science reform. Closer to traditional technical assistance centers, the major benefits and challenges involved in this regional model are quite similar to those discussed in combined mathematics and science Centers, including the following:

- Regional Centers can have a strong client orientation and provide services over the long term, thus helping districts to implement new curricula over multiple years.

- Regional Centers have the potential of working with districts and schools, both in mathematics and science, and over multiple grade levels.

- Regional Centers can "broker" between districts and other resources that can support their efforts to improve their mathematics and science programs.

- A challenge for these Centers lies in the demands that fall upon staff to be experts in a wide range of curricula and subject matter.

- Furthermore, if one imagines multiple regional Centers, it is difficult to see how those with expertise in the curricula (developers, publishers, and teachers) could work with all of the regional Centers.

Summary

The three types of Center structure, and different orientations to geographical service, all offer different design choices. The regional choice clearly offers strong ongoing relationships with local client districts, schools and teachers. The national Center with geographic hubs offers strong national coverage and a network of local sites all involved in assisting the central site in disseminating innovative curricula. The national model with curriculum development projects as satellites offers strong connections with the discipline as well as deep knowledge of the specific curricula. And, clearly, there are associated challenges and "downsides" to each choice.

3) Grade Level Foci

Another clear choice for Center designers is the grade level to be served by the Center. Currently, three of the eight Centers focus on all K-12 grades. The other five Centers focus either on high school, middle school, elementary school, or both elementary and middle school. There are many combinations possible, and again, there are tradeoffs with each choice.

Centers that Focus on Particular Grade Levels

The advantages and disadvantages of grade level focus are the following:

- Centers that focus on a particular grade level band (e.g., high school) can develop staff, programs and approaches that are tailored to that level. Participants argued, and our own research confirms, that high school is very different from middle school, which is very different from elementary school. The sociology of the teaching profession is very different at each level, the traditions and values are different, and the issues faced by curriculum reformers are different. Hence, there are good reasons to focus on and specialize in promoting curricular reform at a specific level. In fact, some conference participants argued that there was more similarity at each grade level across disciplines – mathematics and science – than there was between levels within the same discipline.

- Focusing on specific grade levels allows for a concentration and networking of curricula, curriculum projects, and curriculum developers – all of whom have worked hard to address the issues of reform at that particular level.

- The downside of grade level concentration is that it makes it more difficult for Centers to help districts with issues of articulation across levels and overall program integration.

- Grade level concentration also probably limits or constricts the long-term work that a Center can do with a district or project, as another Center would then need to be involved in working at the other grade levels.

- Finally, Centers that are K-12 in focus can serve a useful function in that they oversee, and can help with, the entire spectrum of mathematics and/or science curricula K-12. They can support the work of grade level-specific centers through research, referrals, and background support for all of the curricula.

Summary

The design choices around grade level, again, reflect beliefs about priorities. If one believes in the primacy of curricular expertise, knowledge of curricula, and knowledge of the culture and processes of different levels of education, then grade level-specific Centers make sense. If one sees a strong need for articulation and overview of the curricula of all grade levels, then K-12 Centers make sense. There may well be an argument for a few Centers of each type, although the initiative must be careful and deliberate about the overlaps.

4) CENTERS THAT HAVE ADDITIONAL FOCI OR SPECIALTIES

It is possible to further define Centers by letting them take on more specific foci and goals. For example, it is possible to have Centers that focus on rural or urban settings. Or, it is possible for them to focus on issues of equity or providing access to under-served schools and districts.

It is also possible to have Centers that focus on a specific level of work (e.g., marketing, or selection, or even implementation). For example, it would be possible to have Centers that only do awareness-building or marketing; or, conversely, it would be possible to have Centers that limit their work to a few districts and work with them in-depth. Hence, depending upon the skills, expertise, experience and propensity of the Center leaders, it is possible to have Centers that "specialize" in a certain audience, or approach, or level of work.

Again there are tradeoffs involved in these various choices:

- Focusing on a particular audience or level of work allows the Center to further develop its own specialized expertise. Centers with clear foci can then match staff, institutional capacity and expertise with the issues and problems being addressed.

- Specialization allows a Center to limit its work to a reasonable scale and provides criteria that allow the Center to prioritize its work.

- A set of Centers, each with its own specialty, could collectively provide strong service to targeted audiences. In this way the overall NSF "portfolio" of Centers could gain strength through its specialization and diversification.

- A portfolio of Centers with specialties could, for example, allow NSF to develop a more intentional and focused approach to equity issues overall. Targeted Centers could increase access to these curricula for districts, schools and teachers who otherwise would be unlikely to encounter them, much less adopt them.

- On the other hand, Centers with specialties and narrow foci could be so selective as to eliminate unnecessarily those districts and projects that could otherwise benefit from their work. Centers that are overly specialized could fail to coordinate their work with other Centers.

- Another disadvantage of having multiple "specialty Centers" is that the rather limited resources available to the pool of all Centers would be further stretched. The spread of resources would have to be equitable, but some levels of work are much more costly than others, both in terms of monies and labor intensity. There is a real danger of spreading resources too thin across the board.

IV. OTHER THOUGHTS ABOUT IMPLEMENTATON AND DISSEMINATION CENTERS

This report thus far has focused on dimensions of design and options within those dimensions. The scenarios presented in the appendix that follows are also meant to stimulate thought and make clear at least some of the critical design choices involved at both the Center and Initiative level. Before concluding the report, we wish to reiterate other important and insightful ideas that emerged from the conference as Center leaders discussed their experiences. The following "big ideas" are meant to summarize strands of conversations and themes that repeatedly arose during the conference.

- **The Centers are doing work that is needed if NSF and other funders hope to maximize the investments they are making in curriculum development projects.**

For decades, NSF, Howard Hughes Medical Institute, and other foundations have invested millions of dollars in the development of innovative curricula. These development efforts have been guided largely by an inquiry-based vision of mathematics and science, and a vision of teaching and learning that is congruent with the national standards. The hope has been that such curricula will prove to be an important tool as districts, schools, and teachers work together to improve the instruction that they are able to offer their students.

Decades of experience have now made it clear that, in some sense, developing curricula is the easiest part of the task. Unlike the baseball park in the movie "Field of Dreams," it is not true that if "you build it, they will come." For the most part, the dissemination, marketing, and support for implementation of these curricula must be as carefully designed and engineered as the development of the curricula itself. In fact, it could be argued that the work of dissemination, marketing, and implementation support requires far more resources, time, and expertise than the development of the curriculum.[7] And, as mentioned before, the level of effort needed for awareness, adoption and implementation can be seen as best measured by a Richter scale.

This first generation of Centers is providing evidence of both the need for and the benefits of a carefully engineered dissemination and support effort. These first Centers are also illustrating the fact that dissemination efforts require a specialized knowledge and expertise that is different from, but equally important as, the expertise needed to develop good curricula. From creating initial awareness, to helping districts with the difficult issues of implementation, the Centers collectively are contributing to the successful usage of the curricula by schools and districts across the country. Equally critical, the Centers are helping districts build their own capacity to sustain a process of ongoing curricular improvement.

For the record, and so that it is not overlooked, we want to say again that the Centers have shown that the investment made in new curricula – curricula that by their very nature are

[7] It is not uncommon in the commercial arena for companies to spend 10 to 100 times as much money on marketing as they spend on product development.

innovative and not in the mainstream – does not make sense unless it is accompanied by a long-term, carefully engineered support effort.

- **The existence and work of the Centers have implications for NSF's curriculum development projects and curriculum development initiatives.**

The relationship between the NSF Implementation and Dissemination Centers and the projects that are funded to develop new curricula should not be construed as a one-way street. That is, it should not be the case that the curriculum developers produce whatever they deem appropriate and then turn over that curricula to the Centers for dissemination and support. Rather, there is now new potential for an increasingly productive and even more symbiotic relationship between curriculum development projects and Implementation and Dissemination Centers.

Heretofore, the NSF curriculum projects were, in some sense, isolated from the field. The Centers, as we described, provide a very real and concrete bridge between developer and consumer, and thus provide a feedback cycle that has been, to date, weak or missing.

It is also important to note that many of the NSF-funded curricula are published by small specialized publishers. They too play an integral role in the overall implementation of these curricula. Many times the interests of publishers, developers, and NSF are well aligned. Without making specific recommendations here, we simply think it is important to think carefully and creatively about the relationships of developer, publisher, and funder as the NSF pursues its investments in curriculum development and dissemination.

The experience of the Centers thus far shows that those individuals who helped to develop the curricula can play a critical role in its dissemination and implementation support efforts. In turn, the Centers can help developers, not only by disseminating their curricula, but also by providing them with extensive experience in working within the real-world contexts of schools and teachers. Such experience is critical in the education of the developer and in the refinement of existing curricula, and in informing the next generation of curricula. In this sense, as we noted earlier, the new Centers are providing a very important link or bridge between the developers and the consumers of curricula.

Finally, it is important to note that the experiences of, and lessons learned by, the Centers may have important implications for NSF and other funders in shaping their future curriculum development initiatives. As the Centers work to disseminate and implement innovative curricula, there are lessons to be learned about the number of curricula to be developed, the nature of the curricula that are needed and marketable, and the timespan or "lifetime" of each curricula. To date, the experience of the Centers suggests that a few well-designed curricula, promoted and supported carefully over a decade or more, may be a better approach than the development of many different curricula every few years. But the point to be made here is not this suggested "finding" – it is too early for that – but rather the fact that the Centers provide a new source of information for NSF and other funders to draw upon as they plan their investments in curriculum development projects.

• The Centers can serve as important "connectors" or "bridges" between other reform efforts.

Not only can Centers connect the developers and consumers of curricula, they can also add value to and link together other reform efforts. Examples may best tell the story here. The Centers have found a very productive relationship with many of the Systemic Initiatives funded by NSF. As a key component of their work, the Systemic Initiatives need to undertake the process of introducing, and then implementing, standards-based curricula. The Centers are proving very helpful to the leaders of Systemic Initiatives in helping them carry out this task. For example, the Appalachian Rural Systemic Initiative asked several Centers to help with the task of introducing new curricula to the very rural counties it was serving. Not only do the Centers conduct workshops and showcases that help inform local teachers and administrators about the new curricula, but they also can help network local leaders with other districts and schools involved in similar efforts. In this way, they are helping to create a kind of national learning community centered on and focused around the task of implementing innovative curricula in local settings.

Another example can be found in the relationship between Centers and pilot LSCs. The pilot LSCs are intended to provide districts with two years of funding so that they themselves can be ready and well-positioned to apply for full LSC funding. One of the critical tasks for pilot LSCs is to learn about, select, and then adopt standards-based curricula. This is exactly what the Centers are designed to do, and thus there is a very good match between the mission of the Centers and the central needs and goals of the pilot LSCs.

Similarly, it is probably worthwhile to point out that the Centers may be very useful resources for the newly created Math and Science Partnerships. While these partnerships bring science and math expertise to districts around the country, it is unlikely that more than a very few of these MSPs will have extensive in curriculum, or curriculum implementation. The Centers could play a very important technical assistance role in helping MSPs address this dimension of reform.

Although mentioned earlier in this report, it is worth repeating that the work of the Centers is also tightly linked to local curricular leadership. For them to accomplish their work, the Centers must identify and be able to work with local leaders who are "ready" to learn about the new curricula, their intended purposes, and the long process involved in shepherding a district through review, selection, and implementation. Similarly, the Centers, by involving local leaders in this work, are not only "selling" specific curricula but they are also deliberately making a significant contribution to the local capacity for reform.

• The Centers themselves need ongoing opportunities to learn from each other and coordinate their work.

The conference in Annapolis made it clear that there is real benefit in providing the opportunity for Center leaders to share and learn from each other. Again, it must be remembered that the Centers are a new invention, and each Center leader is essentially finding his/her own way through the myriad of design choices. Especially in the early stages of this enterprise, it is very

important to support Centers in interacting with each other and even in coordinating their work. The NSF-funded annual Gateways Conference is helpful in this respect, but more is needed.

- **There are still important issues to resolve in defining the work of the Centers.**

There are at least four important issues that need to be resolved in defining the work of the Centers. Resolution must occur at the Initiative level, and with the clarification of these issues the next generation of Center leaders will be enabled to focus their work more effectively.

The first issue is that of determining the curricula to be included within a Center's mandate. Is a Center to consider only NSF-funded curricula? Or is a Center to include all "standards-based" curricula? Or is a Center to define the criteria for inclusion (much as curriculum developers define the criteria they will use in developing new curricula)? This is an important issue to resolve for both substantive and political reasons.

The second issue of clarification of the Centers' work is to help them define, and even limit, the degree to which they are to assist districts with "implementation." As we pointed out before, the LSCs and the Systemic Initiatives are provided with more resources and a clear mandate to help districts, schools and teachers fully implement standards-based materials. (It is worth noting that even with ten times the resources, these projects struggle to accomplish that mission.) Hence, it is not yet clear to what extent and in what ways Centers should pursue the goal of "implementation." We do not think that there is a need for a uniform answer to this question, but some guidelines are clearly needed.

The third issue has to do with the scale and lifetime of Centers and of the curricula they support. The current Centers, it can be reasonably argued, are operating at a minimum scale of funding. An "order of magnitude" argument will show that current Center funding (on the order of 12 million dollars per year for all eight Centers) comes to approximately $750 dollars per district or $150 per school in the United States. Even if one thinks of a potential realistic audience of 10% of all schools being ready for standards-based curricula, this allows for a total of $7,500 per district or $1,500 per school. (The allocation for LSCs, by contrast, is approximately $3,000 per teacher.) These sums have to cover K-12 mathematics and science, including all marketing costs, all seminars, and all support for implementation. Hence, it is clear that the current Centers are very limited in scale and thus in some senses the entire initiative could be considered exploratory. If NSF wishes to optimize its investment in curricula, then the amount of effort and resources devoted to dissemination and implementation will more nearly have to match or even exceed the investment made in curriculum development.

Finally, it is important for NSF to think about the lifetime of Centers and of the curricula they support. Centers, like any other institutional endeavor, require expenditure in time and effort to build their own capacity. Center staff need to be skilled in marketing, in educating district leaders about systemic reform, in professional development design, and in the politics of reform. They must be deeply knowledgeable about the curricula they are promoting, as well as about the specific challenges of curriculum implementation that arise at different grade levels

and in different subject matters. The need for such expertise argues for a long-term perspective when thinking about the investment to be made. Thus, we think it is important for NSF to think about ways in which the Center effort can be designed to be cumulative and ongoing, while, at the same time, not providing life-long entitlement to any one Center or curriculum.

- **The work of the Centers, and the issues they encounter, can help to sharpen the "theory of action" of NSF and other funders as they invest in new curricula.**

The Centers are showing that innovative standards-based curricula can serve many important purposes in promoting reform. The existence of standards-based curricula allows a district that is new to reform to get started in a very concrete fashion. (This is very similar to how a well-designed science kit helps an elementary teacher begin the move toward inquiry-based instruction.) At the other end of the spectrum, it is clear from the Centers' experiences that standards-based curricula are a key element of, and add real value to, sophisticated systemic reform initiatives. And, as we discussed, curriculum implementation is a process that is highly supportive of the development of local leadership.

It should now be clear to the reader that the Centers are not simply about the "selling" of NSF-funded curricula. Yes, they are involved in helping districts learn about these new curricula, but they are involved in far more than that, and their goals are multiple and ambitious. In fact, the market share of any one of these curricula is likely to be relatively small when viewed on a national scale, and thus the *raison d'être* of this work must be more than simply capturing a market share.

Even though market share is likely to be small, the potential benefits of curriculum development and implementation can be large. Having five to ten percent of all classrooms involved in a very different approach to teaching and learning is an important and necessary first step toward the goal of achieving high-quality instruction for all students in the nation. The goal of developing local leaders, both for and through curriculum implementation, is an important contribution to the nation's capacity for high-quality mathematics and science programs. The investment in Centers, as a way to add value to and strengthen the other initiatives that NSF is funding, is also a sound investment.

And finally, the research and learning that can be gleaned from the work of the Centers – the deeper understanding of curricular-led reform – is also an important and not yet fully realized benefit of this work. We think it is important for NSF and other funders to become increasingly clear and explicit about the goals and the "change strategy" they are pursuing as they support the development and implementation of new curricula. Doing so not only will help curriculum developers and Implementation and Dissemination Centers do their work, but it will also more broadly help make the case for investing in the production and dissemination of all the NSF-funded curricula.

APPENDIX

PUTTING IT ALL TOGETHER:

THREE DESIGN SCENARIOS

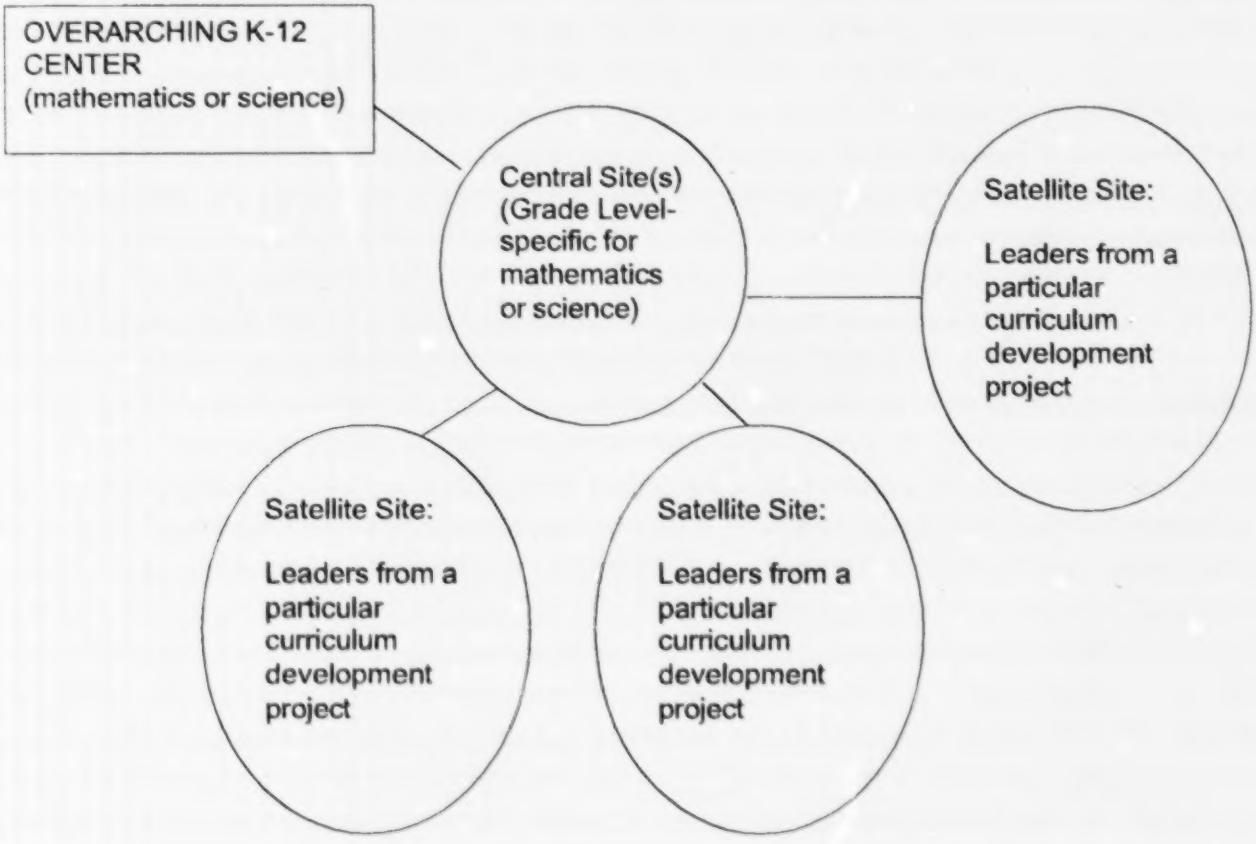
In this appendix we summarize how the design choices presented in the earlier sections of this report can be brought together to form different scenarios for the Implementation and Dissemination Centers. These scenarios are not meant to be exhaustive; nor are they meant as recommendations. Rather we believe they are realistic and even probable visions for the kinds of Centers imagined by the participants at the conference. They represent three possible ways to think about Center designs both at the Center and Initiative levels -- with each scenario emphasizing a different set of priorities in the key design dimensions.

Scenario One - National Centers with Curricular Satellites

This scenario was formulated and articulated by the group of mathematics Centers participants working in a small group format at the conference. (For this reason, it is probably the most specific in terms of detail.) It places the relationship with the curricula and curriculum developers at the highest level. In this model there are Centers in mathematics and science for each grade level band (elementary, middle, and high school) and there is also an overarching K-12 Center for mathematics and a similar K-12 Center for science. Thus, there are eight Centers overall: four in mathematics and four in science; two at the elementary level, two at the middle school level, two at the high school level, and two overarching K-12 Centers.

Each grade level Center is itself composed of a "central node" with curriculum projects as satellites. The central site is responsible for promoting all the curricula and for helping districts learn more about the shared nature and purpose of all the curricula. This central node can then refer more specific questions to the appropriate curriculum leaders located at the satellite sites. The satellite sites are also then responsible for providing long-term support to districts for the implementation of their own curricula.

Scenario One: National Centers with Curricular Satellites

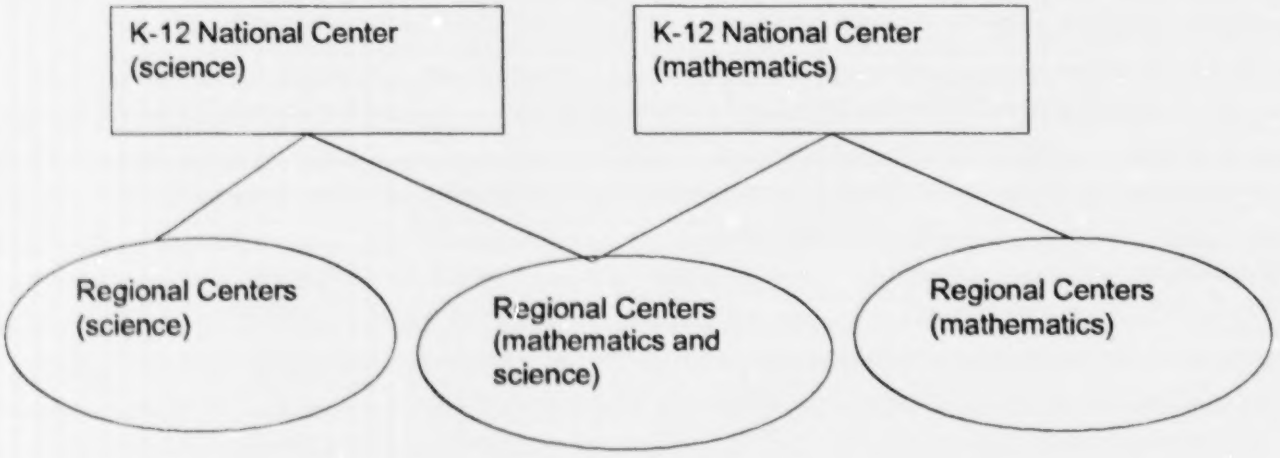

OVERARCHING K-12 CENTER (mathematics or science)
Central Site(s) (Grade Level-specific for mathematics or science)
Satellite Site: Leaders from a particular curriculum development project
Satellite Site: Leaders from a particular curriculum development project
Satellite Site: Leaders from a particular curriculum development project

The rationale for this scenario includes the following arguments:

- The satellites and the K-12 Center specialize in mathematics or science, in the curricula, and at the grade levels they know best.
- The structure for the direct involvement of curriculum developers helps them to work in efficient ways with districts and schools that are interested in and ready to implement their curricula.
- This configuration also provides for an umbrella K-12 site that can network and support the three grade level Centers, as well as provide for national marketing of all the curricula.

Scenario Two - Regional Mathematics and Science Centers

In this scenario, the initiative would fund a set of K-12 mathematics and science Centers across the country. (There might be combined Centers or separate Centers for mathematics and science.) Each of these Centers would be responsible for carrying out all levels of work – review, selection and adoption, and long-term implementation support. The Centers would be joined and assisted by two national Centers - a K-12 mathematics and a K-12 science Center.



There could be multiple regional Centers (though probably no more than six) and some could have special foci as well (e.g., rural, technology, etc.).

The rationale for this scenario includes the following arguments:

- The regional and local focus of the regional Centers allows for long-term relationships with districts and schools. Hence, the Centers would be positioned to provide the long-term support needed for implementation, as well as ongoing awareness building and seminar-level efforts.

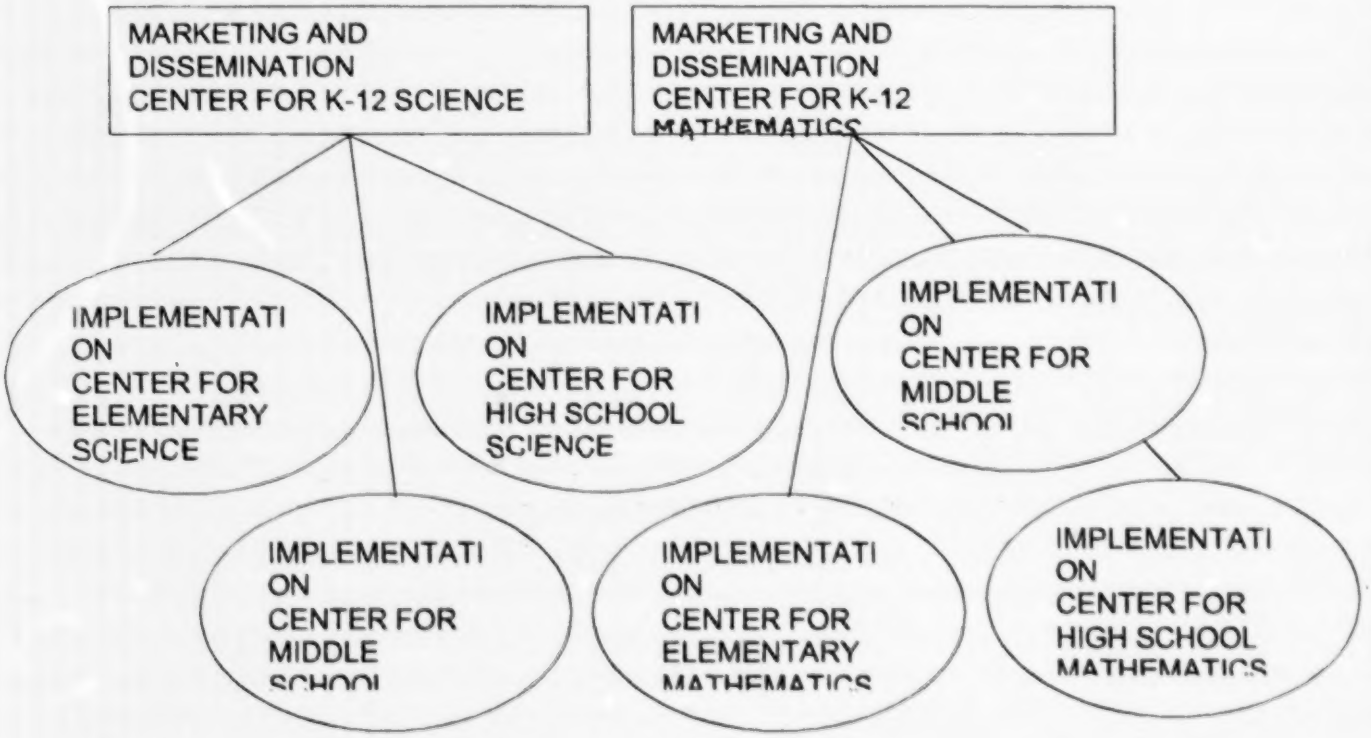
- The overarching K-12 Centers could help support and connect the work of the regional Centers, allowing them to learn from and contribute to each other's efforts. The K-12 Centers could also help coordinate the connection of the Centers with the specific curriculum projects.

- The Centers could work together to provide careful national coverage, as well as pool their expertise to support each other by sharing strengths among all Centers.

Scenario Three - Centers Specializing in Different Levels of Work

These Centers would place the level of work (review, selection, and implementation) as the central organizing feature. (This is a model described in part by Naida C. Tushnet, et al., in

their report "Evaluation of Instructional Materials Development Implementation Sites: Interim Report, January 2001.") Both mathematics and science would each have a "Center" (or several) devoted to the dissemination and marketing of the selected curricula. There would be additional Centers that focus on long-term implementation of the curricula.


MARKETING AND DISSEMINATION CENTER FOR K-12 SCIENCE
MARKETING AND DISSEMINATION CENTER FOR K-12 MATHEMATICS
IMPLEMENTATION CENTER FOR ELEMENTARY SCIENCE
IMPLEMENTATION CENTER FOR HIGH SCHOOL SCIENCE
IMPLEMENTATION CENTER FOR MIDDLE SCHOOL
IMPLEMENTATION CENTER FOR MIDDLE SCHOOL
IMPLEMENTATION CENTER FOR ELEMENTARY MATHEMATICS
IMPLEMENTATION CENTER FOR HIGH SCHOOL MATHEMATICS

The rationale for this scenario includes the following arguments:

- The different levels of work require very different strategies and involve very different kinds of work. Hence, each needs very different types of expertise. Wide-scale marketing is a completely different task, it can be argued, than assisting a district with professional development design and classroom coaching models. Thus, separating Centers on the basis of the type of work to be done makes some sense.

- The K-12 marketing Centers could establish districts that are ready for implementation and then refer these districts to the specific Centers that could follow up with long-term implementation support.

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